

## **COMPLETE LISTING OF THE CLAIMS**

The following lists all of the claims that are or were in the above-identified patent application. The status identifiers respectively provided in parentheses following the claim numbers indicate the current statuses of the claims.

1. (Currently Amended) An interconnect system comprising:
  - a first circuit unit integrated on a first chip containing a first electronic circuit and a plurality of modulators, wherein:
    - the first electronic circuit produces a plurality of electrical output signals;
    - and
    - each modulator is controlled by a corresponding one of the electrical output signals and is capable of modulating a corresponding component of a first optical signal output from the first circuit unit; and
  - a second circuit unit integrated on a second chip containing a second electronic circuit and a plurality of detectors, wherein:
    - the second electronic circuit processes a plurality of electrical input signals;
    - and
    - each detector is capable of detecting modulation of a corresponding one of the components of the first optical signal to extract a corresponding one of the input signals, wherein  
the first chip and the second chip are mounted on a substrate for transmission of the first optical signal between the first and second chips.
2. (Previously Presented) The system of claim 1, wherein:
  - the second circuit unit further comprises a second plurality of modulators, wherein each modulator in the second circuit unit is capable of modulating a corresponding component of a second optical signal; and
  - the first circuit unit further comprises a second plurality of detectors, wherein each detector in the first circuit unit is capable of detecting modulation of a corresponding one of the components of the second optical signal to extract a corresponding electrical signal.
3. (Previously Presented) An interconnect system comprising:
  - a first circuit unit containing a first electronic circuit, a photonic bandgap crystal, and a plurality of modulators, wherein:
    - the first electronic circuit produces a plurality of electrical output signals;

and

each of the modulators is controlled by a corresponding one of the electrical output signals, is capable of modulating a corresponding component of a first optical signal output from the first circuit unit, and comprises a defect within the photonic bandgap crystal and an electrode adjacent to the defect, wherein the defect acts as a resonator for the corresponding component of the first optical signal and has an optical property that varies with a voltage applied to the electrode; and

a second circuit unit containing a second electronic circuit and a plurality of detectors, wherein:

the second electronic circuit processes a plurality of electrical input signals; and

each detector is capable of detecting modulation of a corresponding one of the components of the first optical signal to extract a corresponding one of the input signals.

4. (Previously Presented) An interconnect system comprising:  
a first circuit unit containing a first electronic circuit and a plurality of modulators, wherein:

the first electronic circuit produces a plurality of electrical output signals; and

each modulator is controlled by a corresponding one of the electrical output signals and is capable of modulating a corresponding component of a first optical signal output from the first circuit unit; and

a second circuit unit containing a second electronic circuit and a plurality of detectors, wherein:

the second electronic circuit processes a plurality of electrical input signals; and

each of the detectors comprises a photodiode at a corresponding defect within a photonic bandgap crystal, wherein the defect acts as a resonator for the corresponding component of the first optical signal, and the detector is capable of detecting modulation of a corresponding one of the components of the first optical signal to extract a corresponding one of the input signals.

5. (Canceled)

6. (Previously Presented) The interconnect system of claim 1, further comprising a first light source that is external to the first chip and provides the first optical signal to the first circuit unit.

Claims 7 to 16 (Canceled)

17. (Previously Presented) An interface for input/output to/from an electronic integrated circuit, comprising:

a photonic bandgap crystal;

a line defect in the photonic bandgap crystal;

a first plurality of point defects within the photonic bandgap crystal, wherein each of the point defects acts as a resonator for a different wavelength of light in the line defect;

a plurality of electrical elements respectively adjacent to the first plurality of point defects, wherein the electrical elements produce electrical input signals of the electronic integrated circuit from respective optical signals having the wavelengths resonant with the adjacent point defects;

a second plurality of point defects that respectively act as resonators for a plurality of different wavelengths of light; and

a plurality of modulators respectively adjacent to the second plurality of point defects, wherein the modulators respectively respond to electrical output signals of the electronic integrated circuit to modulate optical signals respectively having the wavelengths that are resonant with the adjacent point defects.

18. (Previously Presented) The interface of claim 17, wherein the modulators comprise a plurality of electrodes respectively adjacent to the second plurality of the point defects, wherein each of the point defects in the second plurality has an optical property that varies with a voltage applied to the adjacent electrode.

19. (Previously Presented) The interface of claim 17, wherein each of the electrical elements comprises a photodiode within the adjacent point defect.

Claims 20 to 39 (Canceled)

40. (Previously Presented) The interface of claim 17, wherein each of the point

defects acts as a drop filter for a different frequency of light.

41. (Previously Presented) The system of claim 3, wherein the first circuit unit further comprises a line defect that acts as a waveguide for the first optical signal in the photonic bandgap crystal, wherein each of the defects in the modulators is adjacent to the line defect.

42. (Previously Presented) The system of claim 41, wherein each of the defects in the modulators comprises a point defect.

43. (Canceled)

44. (Previously Presented) The system of claim 3, wherein a material in each of the defects has a refractive index that depends on an electric field in the material; and the electronic output signals are respectively applied to the electrodes to change the electric fields in the respective defects.

45. (Previously Presented) The system of claim 44, wherein the material in the point defect comprises lithium niobate.

46. (Previously Presented) An interconnect system comprising:  
a first circuit unit containing a first electronic circuit and a plurality of modulators,  
wherein:

the first circuit unit produces a plurality of electrical output signals and  
comprises: a first waveguide for input of light that includes a plurality of frequency  
components; a plurality of drop filters positioned to respectively extract and  
separate the plurality of frequency components from the first waveguide, wherein  
the plurality of modulators are respectively associated with the plurality of drop  
filters, each modulator being capable of modulating the frequency component  
extracted by the drop filter associated with the modulator; and a second waveguide  
into which the frequency components from the modulators are directed; and  
wherein

each modulator is controlled by a corresponding one of the electrical output  
signals and is capable of modulating a corresponding component of a first optical  
signal output from the first circuit unit; and

a second circuit unit containing a second electronic circuit and a plurality of detectors, wherein: the second electronic circuit processes a plurality of electrical input signals; and each detector is capable of detecting modulation of a corresponding one of the components of the first optical signal to extract a corresponding one of the input signals.

47. (Canceled)

48. (Previously Presented) An interconnect system comprising:  
a first circuit unit containing a first electronic circuit and a plurality of modulators, wherein:

the first electronic circuit produces a plurality of electrical output signals;  
and

each modulator is controlled by a corresponding one of the electrical output signals and is capable of modulating a corresponding component of a first optical signal output from the first circuit unit; and

a second circuit unit containing a second electronic circuit, a plurality of detectors, and a photonic bandgap crystal containing a plurality of defects, wherein:

the second electronic circuit processes a plurality of electrical input signals;

each of the defects acts as a drop filter for a different wavelength of light; and

the plurality of detectors are respectively associated with the plurality of defects, wherein each detector is capable of detecting modulation of a corresponding one of the components of the first optical signal to extract a corresponding one of the input signals by generating an electrical signal that indicates a modulation of a light signal extracted by the associated defect.

49. (Previously Presented) An interconnect system comprising:  
a first circuit unit containing a first electronic circuit and a plurality of modulators, wherein:

the first electronic circuit produces a plurality of electrical output signals;  
and

each modulator is controlled by a corresponding one of the electrical output signals and is capable of modulating a corresponding component of a first optical signal output from the first circuit unit; and

a second circuit unit containing a second electronic circuit and a plurality of detectors, wherein:

the second circuit processes a plurality of electrical input signals and comprises: a waveguide for the first optical signal; and a plurality of drop filters positioned to respectively extract the components of the first optical signal from the waveguide, wherein the plurality of detectors are respectively associated with the plurality of drop filters, each detector being capable of detecting modulation of the component corresponding to the drop filter associated with the detector to extract from the first optical signal a corresponding one of the input signals.

Claims 50 to 60 (Canceled)

61. (Currently Amended) The system of ~~claim 60~~ claim 1, further comprising a source of light in the first optical signal wherein the source is mounted on the substrate.

62. (Previously Presented) An interconnect system comprising:  
a first circuit unit containing a first electronic circuit and a plurality of modulators, wherein:

the first electronic circuit produces a plurality of electrical output signals;  
and

each modulator is controlled by a corresponding one of the electrical output signals and is capable of modulating a corresponding component of a first optical signal output from the first circuit unit; and

a second circuit unit containing a second electronic circuit and a plurality of detectors, wherein:

the second electronic circuit processes a plurality of electrical input signals;  
and

each detector is capable of detecting modulation of a corresponding one of the components of the first optical signal to extract a corresponding one of the input signals, wherein

the first and second circuit units are integrated in a chip, and the first optical signal propagates from the first circuit unit to the second circuit unit within the chip.